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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/635,621	08/06/2003	Hsi-Kuei Cheng	TSM02-0971	8481
43859	7590	11/18/2004	EXAMINER	
SLATER & MATSIL, L.L.P. 17950 PRESTON ROAD, SUITE 1000 DALLAS, TX 75252			NGUYEN, HA T	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 11/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/635,621

Applicant(s)

CHENG ET AL.

Examiner

Ha T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 September 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 and 22-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 22-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Notice to applicant

1. Applicants' Amendment and Response to the Office Action mailed 7-27-4 has been entered and made of record.

DETAILED ACTION

Claim Rejections - 35 USC § 102

- 1a. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim 10 is rejected under 35 U.S.C. 102(b) as being anticipated by Cave et al. (USPN 6313024, hereinafter "Cave").

Referring to Figs. 1-8 and related text, Cave discloses a method of depositing a conductive layer over an integrated circuit the method comprising: providing a substantially completed integrated circuit, the substantially completed integrated circuit including a silicon nitride passivation layer 76-85 at an uppermost surface; forming an oxide buffer layer 86 over and abutting the silicon nitride passivation layer, the oxide buffer layer having a thickness substantially smaller than a thickness of the passivation layer forming a metal layer 88 over and abutting the oxide buffer layer; and patterning the metal layer (see par. bridging cols. 7 and 8).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103[©] and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 12-13 and 22-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cave.

Referring to Figs. 1-8 and related text, Cave discloses [Re claim 22] a method of forming a semiconductor device, the method comprising: providing a silicon substrate having a plurality of active devices formed therein, the active devices being interconnected by a plurality of metal layer including an uppermost metal layer, the uppermost metal layer including a plurality of contact portions; forming a nitride passivation layer overlying the uppermost metal layer except for a portion of the contact regions; forming an oxide buffer layer overlying the nitride passivation layer, the oxide buffer layer having a thickness substantially smaller than a thickness of the nitride passivation layer; and forming a post passivation metal layer overlying the oxide buffer layer, the post passivation metal layer patterned so as to electrically couple the plurality of contact regions to a plurality of contact pads formed in the post passivation metal layer (See par. bridging cols. 7 and 8). It is inherent that the silicon nitride layer do not cover the portions of the contact regions for the metal layer to be in contact with the underlying devices. But it fails to disclose expressly a plurality of contact pads. However it would have been obvious to a person of ordinary skills in the art to have more than one contact pads to have more than one devices connected to outside devices.

[Re claim 23] Cave also discloses wherein forming a nitride passivation layer comprises forming a silicon nitride layer and wherein forming an oxide buffer layer comprises forming a silicon oxide layer (See par. bridging cols. 7 and 8) ; and

[Re claim 28] wherein the uppermost metal layer comprises a layer of copper (see par. bridging cols. 2-3 or 6-7).

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[Re claims 12-13 and 24-25] Cave fails to disclose wherein forming an oxide buffer layer comprises forming an oxide buffer layer with a thickness of less than 25 nanometers; wherein thickness of the nitride passivation layer is at least about 20 times greater than the thickness of the oxide buffer layer. However any variation in thickness in the present claims is obvious in light of the cited art, because the changes in thickness produce no unexpected function.

The routine varying of parameters to produce expected changes are within the ability of one of ordinary skill in the art. Patentability over the prior art will only occur if the parameter variation produces an unexpected result. In re Aller, Lacey and Hall, 105 U.S.P.Q. 233, 235. In re Reese 129 U.S.P.Q. 402, 406.

[Claim 26] Cave also discloses wherein the uppermost metal layer includes a plurality of contact regions disposed around the periphery of the chip and the contact pads are arranged over a central portion of the semiconductor chip (see Fig. 9 and related text).

Therefore, it would have been obvious to combine with to obtain the invention as specified in claims 12-13 and 22-26.

5. Claims 1, 6-7, and 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cave, as applied above, in view of Mehta et al. (USPN 6261944, hereinafter "Mehta").

[Re claim 1] Referring to Figs. 1-8 and related text, Cave discloses substantially the limitations of claim 1, as shown above. But Cave fails to disclose expressly the step of removing a top portion of the buffer layer. However, the missing limitation is well known in the art because Mehta discloses this feature (See col. 5, lines 22-53). A person of ordinary skill is motivated to modify Cave with Mehta to obtain device of planar surface for ease of formation of subsequent layers of uniform thickness ensuring better control of device quality and reliability.

[Re claims 6-7] Cave also discloses wherein the passivation layer comprises a layer of silicon nitride and wherein the passivation layer comprises more than one layer and wherein an uppermost layer comprises silicon nitride (see par. bridging cols. 7-8).

[Re claims 8-9] Arguments used for the rejection of claims 12-13 and 24-25 also apply.

Therefore, it would have been obvious to combine Cave with Mehta to obtain the invention as specified in claims 1, 6-7, and 8-9.

6. Claims 2-5, 11, and 29-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cave in view of Mehta, as applied above, and further in view of Fan (USPN 6022809).

The combined teaching of Cave and Mehta discloses substantially the limitations of claims 2-5, 11, and 29-33, as shown above. But it fails to disclose expressly wherein the top portion of the buffer layer is removed in a cleaning chamber having an inner wall comprising primarily quartz; wherein the cleaning chamber is in a vacuum condition during the removing step and wherein the post passivation metal layer is deposited over the buffer layer after the removing step without breaking the vacuum condition in the cleaning chamber; wherein passivation layer is formed in a first chamber that is in a vacuum condition and wherein the buffer layer is formed over the passivation layer in the first chamber and without breaking the vacuum condition in the first chamber after forming the passivation layer; wherein the top portion of the buffer layer is removed in the first chamber, the method further comprising breaking a vacuum condition in the first chamber before the step of etching the buffer layer. However, the missing limitations are well known in the art because Fan discloses that a vacuum chamber having inner walls of primarily quartz is used to etch material (See par. bridging cols. 5 and 6). A person of ordinary skill is motivated to modify Cave and Mehta with Fan to obtain device containing less contaminants ensuring better quality. The combination of the applied references does not expressly disclose the details about the vacuum condition in etching and depositing different layers. However it would have been obvious for a person of ordinary skills in the art to use one or a suitable number of chambers to etch and deposit different materials to meet the availability of equipment and the requirements in cost and quality of the devices made.

Therefore, it would have been obvious to combine Cave and Mehta with Fan to obtain the invention as specified in claims 2-5, 11, and 29-33.

7. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cave, as applied above, in view of Carey et al. (USPN, hereinafter "Carey").

Cave discloses substantially the limitations of claim 27, as shown above.

But Cave fails to disclose expressly providing a package substrate having a plurality of contact pads arranged in a configuration corresponding to the contact pads on the semiconductor

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chip; and attaching the contact pads of the package substrate to the contact pads on the semiconductor chip via a plurality of solder bumps, wherein the solder bumps electrically couple the contact pads on the semiconductor chip with the contact pads on the package substrate.

However, it is well known in the art because Carey discloses this feature (See fig. 1).

A person of ordinary skill is motivated to modify Cave with Carey to connect a chip to a carrier substrate.

Therefore, it would have been obvious to combine Cave with Carey to obtain the invention as specified in claim 27.

Response to Amendment

8. Applicants' arguments with regard to the rejections under 35 U.S.C. 102 or 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicants argued that Cave does not disclose "forming an oxide buffer layer over and abutting the silicon nitride passivation layer, the oxide buffer layer having a thickness substantially smaller than a thickness of the passivation layer". The examiner disagreed, Fig. 8, clearly shows the combination of the layers 76-85 including silicon nitride, abutting the oxide buffer layer 86, which has a thickness substantially smaller than the thickness of the combined passivation layer.

It appears that applicant's arguments are largely directed to what the cited references teach individually. However, it is axiomatic that one cannot show nonobviousness by attacking references individually where the rejection, as here, is based on a combination of references. *In re Young*, 403 F.2d 754, 159 USPQ 725 (CCPA 1968); *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). For example, applicants argued that the cited references are not applicable or relevant to "forming post passivation interconnects for an integrated circuit having a plurality of contact regions". The primary reference, Cave is directly related to the field of the claimed invention, formation of post passivation interconnects, formation of passivation layers and bond pads for connection to external devices, and discloses most features of the claimed invention. The secondary references Mehta and Carey are both related to the fabrication of bond pads used for connection to external devices, they are closely related to the primary reference and combinable to the primary reference, as shown in the rejection. In the combined teaching of

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Cave and Mehta, a portion of the buffer layer would be removed before the post passivation metal layer is formed. Note that even when they may not expressly stated or shown, a plurality of bond pads are formed (see Cave, Fig. 9) and the bond pads are connected to selected portions of the wirings and devices in the structures in order to make connections between internal devices and external devices, as is well known in the art. Applicants' arguments about the unclaimed features of the specification are not deemed relevant.

Therefore Cave or the combined teaching of Cave with the applied references do teach or make obvious all the limitations of the rejected claims 1-3 and 22-33.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha T. Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John F. Niebling, can be reached on (571) 272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications

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may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Ha Nguyen

Primary Examiner

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